



US007270100B2

(12) **United States Patent**  
**Ruppel et al.**

(10) **Patent No.:** **US 7,270,100 B2**  
(45) **Date of Patent:** **Sep. 18, 2007**

(54) **ELECTRIC START MINI-CULTIVATOR**

(75) Inventors: **Mark Ruppel**, Cumberland, WI (US);  
**Ronald Ruppel**, Cumberland, WI (US)

(73) Assignee: **Ardisam, Inc.**, Cumberland, WI (US)

(\* ) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **11/477,193**

(22) Filed: **Jun. 27, 2006**

(65) **Prior Publication Data**

US 2007/0006839 A1 Jan. 11, 2007

**Related U.S. Application Data**

(63) Continuation-in-part of application No. 11/071,491, filed on Mar. 3, 2005, now abandoned.

(51) **Int. Cl.**  
*F02N 11/00* (2006.01)  
*F02N 3/02* (2006.01)

(52) **U.S. Cl.** ..... **123/179.24**; 123/179.25

(58) **Field of Classification Search** ..... 123/179.24,  
123/179.25, 179.28, 185.2, 185.3, 185.4,  
123/185.1; 172/42

See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

111,885 A \* 2/1871 Deutsch ..... 73/444

3,536,051 A *	10/1970	Hamman	.....	123/179.26
3,596,647 A *	8/1971	Heisler	.....	123/179.26
4,421,176 A *	12/1983	Tuggle et al.	.....	172/41
4,909,200 A *	3/1990	Sumi	.....	123/179.24
5,345,900 A *	9/1994	Wisegerber	.....	123/179.24
6,218,799 B1 *	4/2001	Hori	.....	318/446
6,540,031 B1 *	4/2003	Sasaoka	.....	172/42
2005/0229889 A1 *	10/2005	Hoevermann	.....	123/179.4

\* cited by examiner

*Primary Examiner*—Stephen K. Cronin

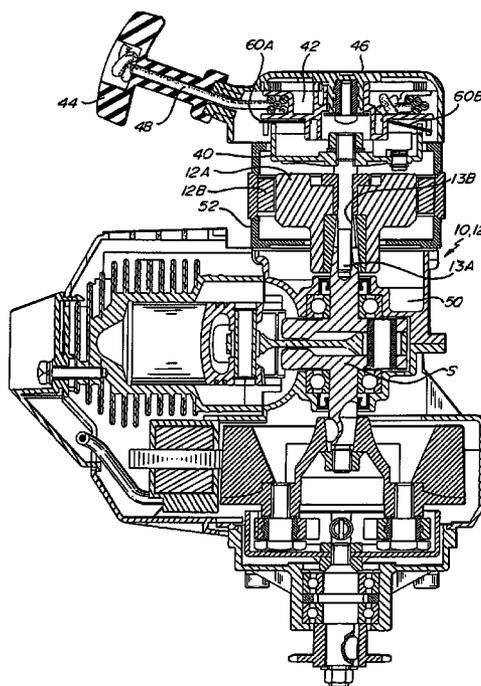
*Assistant Examiner*—Arnold Castro

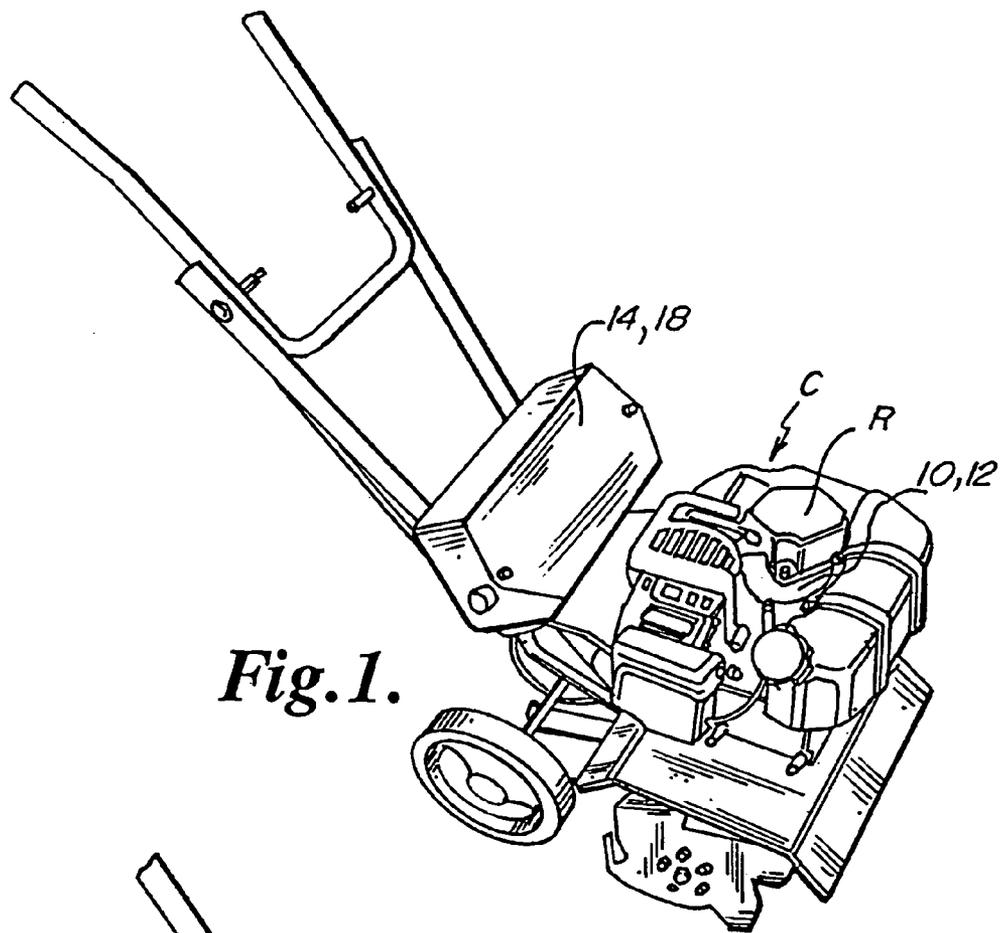
(74) *Attorney, Agent, or Firm*—Gerald E. Helget; Briggs and Morgan, P.A.

(57) **ABSTRACT**

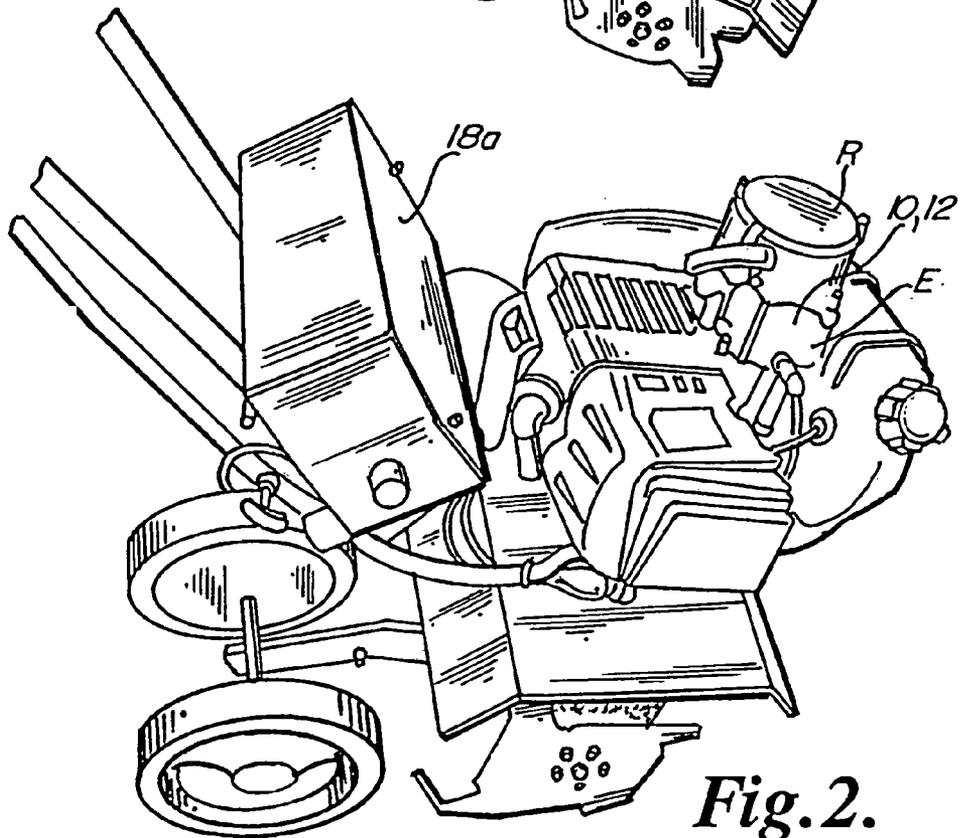
An electric starter for a walk-behind, powered, rotary cultivator having a gasoline engine having a crankshaft and a recoil starter connected to the gasoline engine. The electric starter includes an electric motor connected to the crankshaft between the recoil starter and the engine so that activation of the electric motor starts the engine and the recoil starter can also be used to start the engine; a battery connected to the electric motor; a start switch between the battery and the electric motor; and a battery charger. The electric starter is intended for use on cultivators generally having less than about 2 horsepower. The recoil starter is intermittently engageable with the crankshaft through the electric motor. The electric motor may also act as a generator supplying electric current to the battery to charge the battery.

**18 Claims, 5 Drawing Sheets**

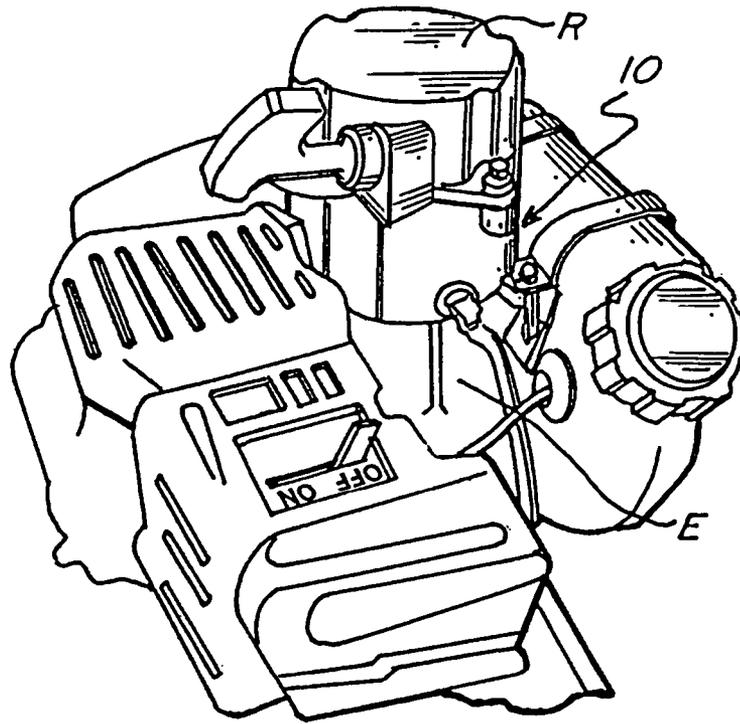




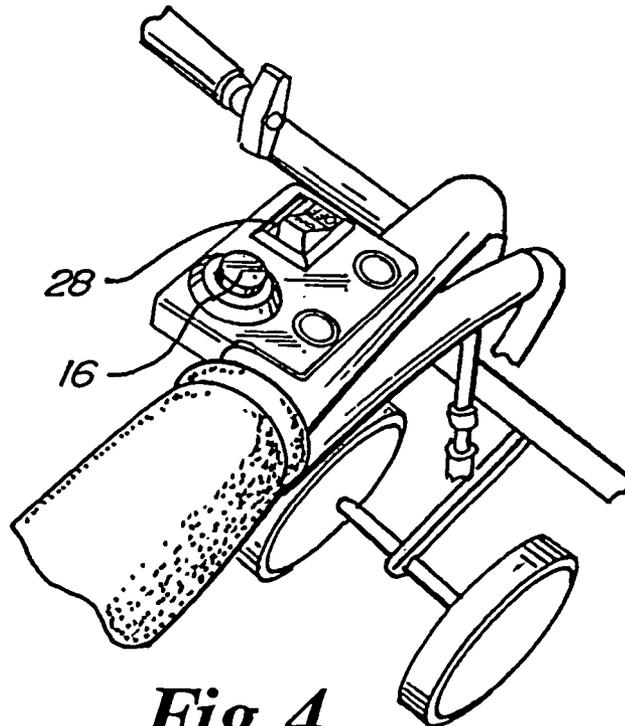
*Fig. 1.*



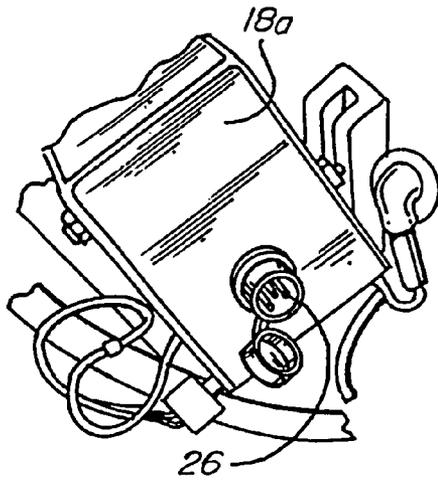
*Fig. 2.*



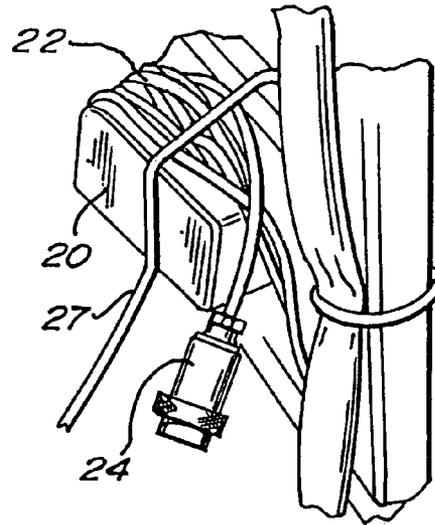
*Fig. 3.*



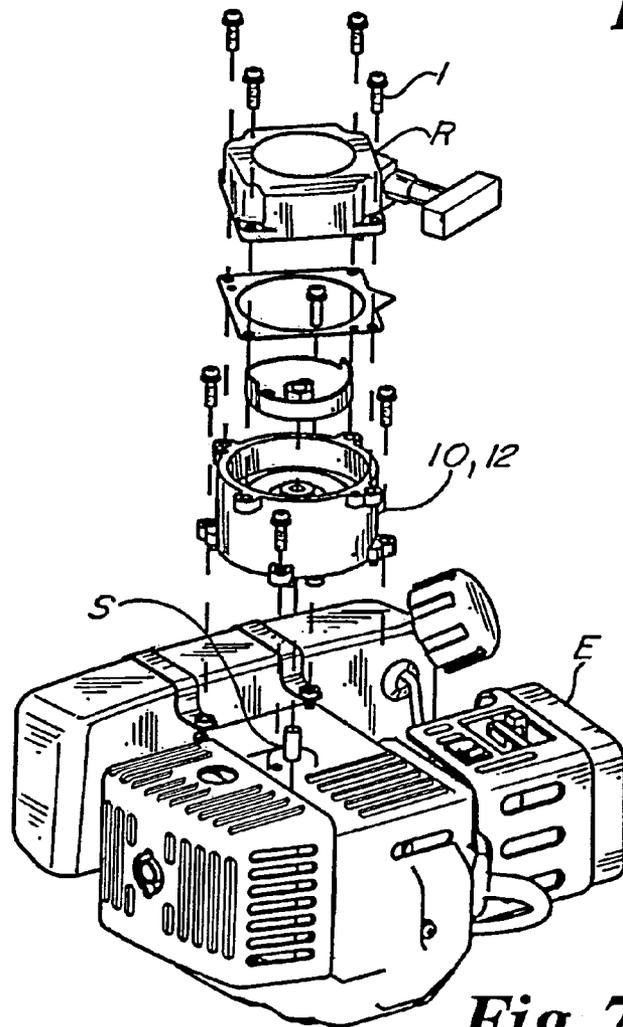
*Fig. 4.*



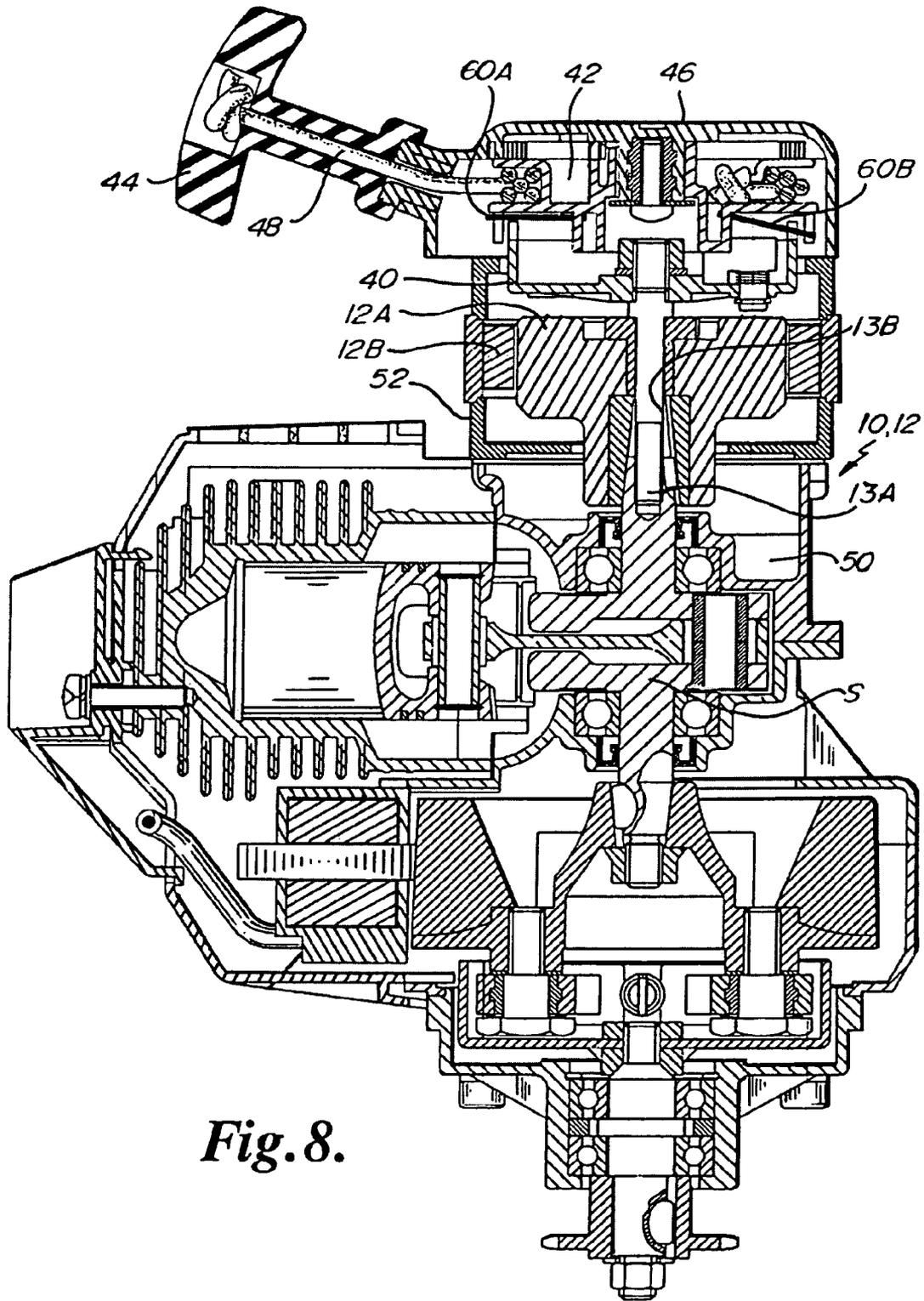
*Fig. 5.*



*Fig. 6.*



*Fig. 7.*



*Fig. 8.*

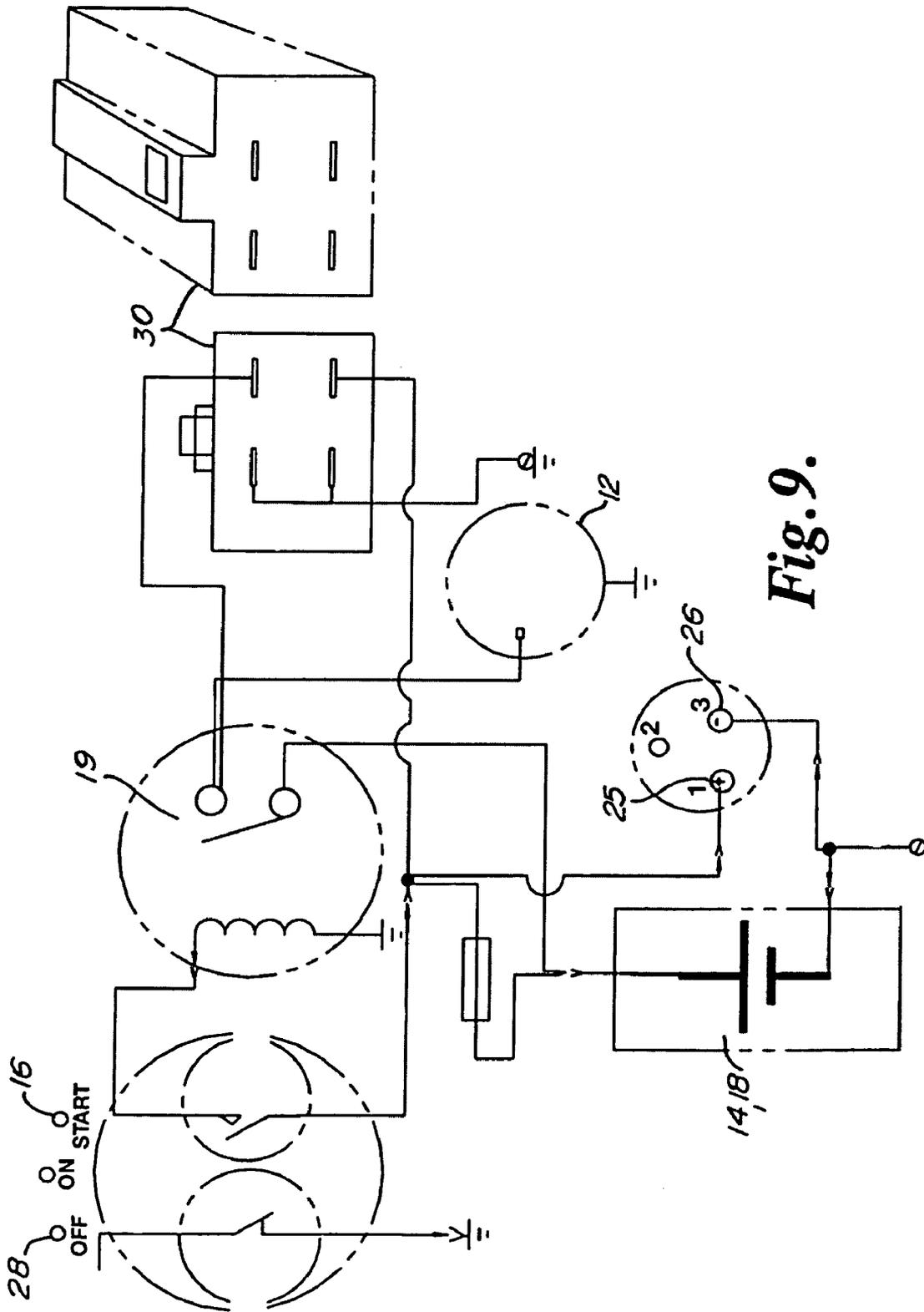


Fig. 9.

**ELECTRIC START MINI-CULTIVATOR**

The present application is a continuation-in-part of application Ser. No. 11/071,491, filed Mar. 3, 2005.

**BACKGROUND OF THE INVENTION**

The present invention relates to a hand supported cultivator as defined in ANSI/OPEI B71.8-1996, and in particular to a hand-supported cultivator with an electric starting motor.

Hand supported cultivators (also known as mini-cultivators) are operator controlled (walk-behind) powered rotary cultivators (generally less than 2 hp), comprised of two handles intended to be easily hand supported by the operator. The rotating tines/tool(s) ensure propulsion away from the operator.

Such mini-cultivators have in the past been hand-started by means of a recoil cord that is pulled by the operator, which then turns the crankshaft to start the engine. A problem with such mini-cultivators is that they are difficult to start using this method.

There is a need for a mini-cultivator with an electric start.

**SUMMARY OF THE INVENTION**

An electric starter for a walk-behind, powered, rotary cultivator having a gasoline engine having a crankshaft and a recoil starter connected to the gasoline engine, the electric starter comprising:

an electric motor directly connected to the engine between the recoil starter and the engine whereby activation of the electric motor starts the engine and whereby the recoil starter can also be used to start the engine;

a battery connected to the electric motor;

a start switch between the battery and the electric motor;

a battery charger; and

wherein the cultivator generally has less than about 2 horsepower.

**BRIEF DESCRIPTION OF DRAWINGS**

FIG. 1 is a front perspective of the cultivator having the present invention attached;

FIG. 2 is a side perspective similar to FIG. 1;

FIG. 3 is a close-up perspective of the present invention and its surroundings;

FIG. 4 is a top perspective of the cultivator having the present invention attached;

FIG. 5 is close-up perspective of the battery housing of the present invention;

FIG. 6 is a close-up perspective of the battery charger of the present invention;

FIG. 7 is an exploded view of the present invention;

FIG. 8 is a cross-section of an engine showing the present invention; and

FIG. 9 is an electrical schematic of the present invention.

**DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT**

The present invention is generally designated in the Figures as reference numeral **10**.

The present invention is an electric starter **10** for a walk-behind cultivator **C** having an engine **E** and a recoil starter **R**. In the usual case, the recoil starter **R** is connected

to the engine crankshaft **S**. However, the invention is envisioned to work with other arrangements.

In the preferred embodiment, the electric starter **10** is connected to the crankshaft **S** between the recoil starter **R** and the engine **E**. The electric starter **10** is connected to the crankshaft **S** in such a way that the recoil starter **R** can alternatively be used to start the engine **E**.

The electric starter **10** is directly and continuously connected to the crankshaft **S**.

In the preferred embodiment, the electric starter **10** further comprises an electric motor **12** and a source of power **14**.

The electric motor **12** comprises a rotor **12A** and a stator **12B**. The rotor **12A** is directly and continuously connected to the drive shaft **S** by a bolt or stud **13A** which passes through a hole **13B** in the rotor **12A**. The stator **12B** is fixed to the generator cover **52**. The rotor **12A** is positioned opposite the stator **12B**.

The apparatus **10** may also comprise a start switch **16** between the source of power **14** and the electric motor **12**. When the start switch **16** is turned to the "START" position, the electric motor **12** rotates and turns the crankshaft of the engine. The engine then starts.

Preferably, the source of power is a battery **18** in a housing **18a** but the source of power may alternatively be any connection to electric current, such as a generator or standard AC power. In one embodiment, the apparatus **10** further comprises a battery charger **20** which can be connected to standard AC power. The battery charger further has a detachable cord **22** with mating connectors **24**, **26**. (FIGS. 5 and 6) Note that the battery charger is not necessarily mounted on the cultivator as shown.

Once the engine starts, the start switch **16** is turned to an "ON" position in which current from the battery **18** is cut off.

Once the engine is started, the electric motor **12** becomes a generator that may supply electric current to the battery **18** to recharge the battery. This electric current is generated as the rotor **12A**, connected to the rotating crankshaft, turns within the stator **12B**.

FIG. 8 is an electrical schematic of the starting system. The starter switch **16** is connected to the battery **18** and to a relay **19**. When the starter switch **16** is closed, the relay **19** switches to complete the connection between the battery **18** and the motor **12**. When the starter switch is moved to the "ON" position, the relay **19** switches to disconnect the battery **18** from the motor **12**. The motor **12** then generates electric current which is carried to the relay **19** and thence through a regulator **30** to the battery **18**, thus recharging the battery **18**.

In the preferred embodiment, for safety reasons, the electric starter **10** further comprises a disable switch **28** that prevents starting of the engine.

The cultivator on which this invention is intended to be used conforms to the standard ANSI/OPEI B71.801996.

In one embodiment, the crankshaft **S** is intermittently connected to a recoil start, to allow the engine to be started manually.

The recoil start includes a recoil clutch assembly **40**, recoil assembly **42**, recoil handle **44**, and recoil cover **46**. A line **48** from the recoil assembly connects to the recoil handle **44**.

Between the crankcase **50** and the recoil cover **46**, is a generator cover **52**. One side of the generator cover **52** is affixed to the crankcase **50** and the other side of the generator cover is affixed to the recoil cover **46**. The rotor **12A** and the stator **12B** assembled with the generator cover **52** constitute the generator, as previously described. The bolt or stud **13A**

3

which connects the rotor 12A to the crankshaft S is suitably connected at its other end to the recoil clutch assembly 40.

With the engine stopped, the recoil assembly is disconnected from the recoil clutch assembly. Any suitable mechanism is envisioned to connect the recoil assembly to the recoil clutch. In the preferred embodiment, to start the engine manually, the operator pulls on the recoil handle 44. As the handle 44 continues to be pulled, a plurality of connector poles or rods 60 move from a position (A, FIG. 8) in which they are disengaged from the recoil clutch assembly to a position (B, FIG. 8) in which they engage the recoil clutch assembly. The recoil clutch assembly is then driven to rotate the rotor 12A to which it is affixed. The rotor 12A, being affixed to the crankshaft S, turns the crankshaft S, causing the engine to start.

When the recoil handle 44 is released, it returns to its original position suitably by a spring (not shown). As this occurs, the poles or rods 60 move out of engagement with the recoil clutch assembly. Thus, as the engine runs, the recoil clutch assembly free-wheels on the spinning rotor 12A.

Unless otherwise defined, all technical and scientific terms used herein have the same meaning as commonly understood by one of ordinary skill in the art to which this invention belongs. Although methods and materials similar to or equivalent to those described herein can be used in the practice or testing of the present invention, suitable methods and materials are described below. All publications, patent applications, patents, and other references mentioned herein are incorporated by reference in their entirety to the extent allowed by applicable law and regulations. In case of conflict, the present specification, including definitions, will control.

The present invention may be embodied in other specific forms without departing from the spirit or essential attributes thereof, and it is therefore desired that the present embodiment be considered in all respects as illustrative and not restrictive, reference being made to the appended claims rather than to the foregoing description to indicate the scope of the invention.

What is claimed:

1. In a hand-supported, walk-behind cultivator having an engine and a recoil starter attached to the engine crankshaft, an electric starting apparatus for starting the engine, the apparatus comprising:

- (a) an electric motor directly connected to the crankshaft whereby activation of the electric motor turns the crankshaft to start the engine;
- (b) a source of power for the electric motor; and
- (c) wherein the electric motor is connected to the crankshaft between the recoil start and the crankshaft, thereby allowing the recoil start to also be used to start the engine.

2. The electric starting apparatus of claim 1, further comprising a start switch between the source of power and the electric motor.

3. The electric starting apparatus of claim 2, further comprising a disable switch preventing the engine from starting.

4. The apparatus of claim 2, wherein the source of power is a battery.

5. The apparatus of claim 4, further comprising a battery charger.

6. An electric starter for a walk-behind, powered, rotary cultivator having a gasoline engine having a crankshaft and a recoil starter connected to the gasoline engine, the electric starter comprising:

4

- (a) an electric motor directly connected to the crankshaft without intermediate components whereby activation of the electric motor turns the crankshaft to start the engine; and
- (b) a source of power for the electric motor.

7. The electric starter of claim 6, further comprising a start switch between the source of power and the electric motor.

8. The electric starter of claim 7, further comprising a disable switch preventing the engine from starting.

9. The electric starter of claim 6, wherein the source of power is a battery.

10. The electric starter of claim 9, further comprising a battery charger.

11. An electric starter for a walk-behind, powered, rotary cultivator having a gasoline engine having a crankshaft and a recoil starter connected to the gasoline engine, the electric starter comprising:

- (a) an electric motor directly connected to the crankshaft in-line between the recoil starter and the crankshaft whereby activation of the electric motor starts the engine and whereby the recoil starter can also be used to start the engine;
- (b) a battery connected to the electric motor;
- (c) a start switch between the battery and the electric motor; and
- (d) a battery charger.

12. The electric starter of claim 11, further comprising a disable switch preventing the engine from starting.

13. A walk-behind, powered, rotary cultivator having a gasoline engine having a crankshaft and a recoil starter connected to the gasoline engine, comprising:

- (a) an electric motor directly connected to the crankshaft in-line between the recoil starter and the crankshaft;
- (b) a battery connected to the electric motor; and
- (c) wherein the recoil starter is intermittently connected to the crankshaft through the electric motor.

14. The cultivator of claim 13, wherein the electric motor further comprises a rotor directly connected to the crankshaft and a stator positioned opposite the rotor.

15. The cultivator of claim 14, further comprising a recoil clutch assembly connected to the rotor and wherein the recoil starter is intermittently connected to the recoil clutch assembly.

16. The cultivator of claim 15, further comprising a plurality of rods pivotally connected to the recoil starter and movable between a first position in which the plurality of rods do not engage the recoil clutch assembly and a second position in which the plurality of rods engage the recoil clutch assembly.

17. The cultivator of claim 14, wherein the electric motor is also a generator supplying electric current to the battery to recharge the battery.

18. A walk-behind, powered, rotary cultivator having a gasoline engine having a crankshaft, comprising:

- (a) a housing further comprising an electric motor directly connected to the crankshaft and a pull starter selectively engageable to the crankshaft to start the engine, wherein the electric motor is in-line between the pull starter and the crankshaft; and
- (b) a source of power for the electric motor.